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## BRIEFER ARTICLES

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### ILLUSTRATING BOTANICAL PAPERS

Long editorial experience in various methods of illustration of the *BOTANICAL GAZETTE* has convinced me that much more adequate and satisfactory results might be secured if authors knew something of the modern methods for reproducing photographs and drawings, and particularly of the requisites for success. Requests for information of this kind, as well as the need felt in the editorial rooms, have determined me to discuss, as briefly as possible, the more important points.

The first question for author and editor to settle is this: Shall the figures be distributed in the text or aggregated into plates? Too often this is unconsidered or decided in conformity to a custom which arose out of necessity in the past. The process of engraving wood and metal by hand was the original and very costly method of illustrating books and monographs. (The journal and short paper were not then in existence.) The invention of lithography offered a vastly cheaper method, which was quickly adopted. The advantage of having figures close to the text they illustrated was surrendered, chiefly on account of the financial advantage, and partly because better effects could be secured by the new process. Modern methods, however, have made possible again the use of the text cut at the point where the figure will be of the most service to the reader. It is highly illogical, therefore, to conclude that because lithographed plates were used in the last century to illustrate the best scientific treatises and monographs, this mode of illustration is today evidence of first-class work. Yet novices are liable to precisely that misconception. There are some cases in which plates are still preferable to text cuts; e. g., when a large series of figures must be before the eye at once, or when the same figure must be referred to at many points. But these cases are much rarer than the prevalence of plates would indicate. Rather this prevalence indicates a want of consideration by the author, who from habit demands plates for a paper, but would never think of illustrating a book so. Having determined whether text cuts or plates are best, the mode of reproduction must be selected, for it is absolutely necessary to adapt the drawings to the chosen mode.

At present the following forms of illustrations appear in scientific journals: (1) lithographs; (2) photolithographs; (3) photogravures; (4)

half-tones; (5) copper and zinc etchings; (6) wood-cuts. I propose to state the nature of each of these, its limitations, its adaptability to special needs, and the requisites, so far as the author is concerned, for successful reproduction of illustrations by each process. Some examples of each are cited from the recent volumes of the *GAZETTE*. This citation does not imply that the "copy" was what it should have been; but when it was not the citation is made in order to show what can be done even when the drawing was poorly adapted to a particular mode of reproduction.

1. **Lithographs.**—These are made by drawing with crayon or pen on a stone or metal plate the design to be printed. It requires an expert draftsman, accustomed to botanical work, to make such drawings well. Even at best the draftsman may make mistakes, or introduce interpretations foreign to the author's design. The chances of error increase the poorer the original drawing and the more the lithographer has to alter it to make it presentable. Thus the only advantage of the intervention of an artistic hand is accompanied by a distinct disadvantage, and this disadvantage is increased by the likelihood that he who can only make a poor representation of his observations is the more likely to overlook errors on the part of the draftsman.

In this country the cost of lithography is almost prohibitive, and the work on histological and cytological subjects is rarely good. The inevitable delays, if drawings are sent to Germany and proofs returned, not to mention other difficulties, make it almost impracticable to attempt lithography. And if good drawings can be furnished, other methods are far better, because they provide for photographically exact reproduction. The only possible reason why a lithograph should be desired lies in the necessity of making poor drawings presentable. This should be obviated, if a second hand must intervene, by employing an artist to make drawings which can be reproduced photographically. Money is much more wisely spent on clear and accurate drawings, which can be corrected at leisure, than on expensive lithographs, with the artist across an ocean or a continent.

Examples:—**32**: pls. 1-3 (German work, cytological); **33**: pls. 10, 11 (American work, entire plants); **30**: pl. 12 (American work, cytological).

2. **Photolithographs.**—These are made by covering the surface of stone or metal with a composition which will become insoluble when exposed to light and printing on this prepared surface a photographic positive of the design. After further preparation the design may be printed on paper by inking the face of the plate. Such printing is done by special power- or hand-presses and cannot accompany the text. It

is available therefore for plates only. It is not an expensive process and gives better results than zinc etchings. It is recommended whenever plates are required. The drawings must be of the same kind as for copper and zinc etchings (see 5).

Examples:—**35**: pls. 4, 5; **36**: pls. 17–20 (printed in paler tinted inks); **37**: pls. 14, 15, 26, 27; **38**: pls. 1–4; and especially **42**: pls. 19–28.

3. **Photogravures**.—These are printed from an etched metal plate or from relief plates, the design being reproduced by rather elaborate mechanical and photographic means. The process is unsuited to anything but plates; and as the prints must be made separately on hand-presses, photogravure is expensive, costing three to four times as much as photolithographs, zinc or copper etchings, or half-tone work. The advantage is that photographs and all kinds of drawings (whether in ink, crayon, or pencil; whether in line or tint or wash) can be reproduced with the utmost fidelity, with an almost perfect rendering of tone and of light and shade. Pencil drawings, however, may be too weak in contrast to permit effective reproduction; and inasmuch as contrast is always somewhat reduced, shaded drawings should show a little more than is desired.

Examples:—**33**: pl. 1 (from pencil drawings); **34**: pl. 17 (from pen and wash); **37**: pls. 11–13 (from pencil and wash); **38**: pls. 6, 7 (from pencil, background removed).

4. **Half-tones**.—These are relief plates, usually of copper, in which the “grain,” instead of being of almost imperceptible dots irregularly distributed as in photogravure, is produced by a screen of ruled lines, whose intersections form equally spaced dots, isolated, or blended with others into irregular lines or surfaces. Half-tone work is adapted to photographs and to varied styles of drawing, like photogravure; but as the “grain” is coarser it does not equal that process in delicacy or range. Yet when the screen used is fine and the workmanship first class, the results are almost as good. It has the very decided advantage that the metal plate may be mounted on a block and may then be printed along with type. It is necessary, however, to use a very smooth paper, either highly calendered or coated with clay. The coated papers are believed to be not durable and are to be avoided whenever possible.

Half-tone work alone is available for reproducing photographs to be printed in the text. Good prints (not negatives) are needed, showing sharply the details desired. Almost any sort of print can be reproduced; but engravers prefer, doubtless from habit, those made on Solio paper, toned brown. In case any painting-out of defects or background is to be done, unglazed prints are preferable.

If wash or pencil drawings are to be reproduced, contrast should be greater than desired, since there is necessarily a light gray background representing the whites of the picture. Except when figures have too intricate outlines this background can be cut away.

Examples:—**35**: 198–207; **38**: 48–57; **37**: 304–5 (which shows what can be done with simple apparatus by cutting away and vignetting the background); **39**: pl. 8 (pencil drawing, background cut away); **39**: pl. 4 (2d issue; from water color); **41**: pls. 1, 2 (from photomicrographs; compare with photogravure from similar originals, **32**: pls. 15–17); **41**: pls. 3, 4 (from pen and pencil, line and stipple, combined with wash; compare with photogravure from similar original, **37**: pls. 11–13).

**5. Copper and zinc etchings.**—All the previous processes are as truly dependent on etching by some solvent as are these. The term is used to distinguish the copper or zinc plates, made without grain or screen, mounted type high and intended for printing on an ordinary press. Copper is used for the finer and more delicate work; zinc where the work is bold. Naturally the copper block is the more expensive. This process is in all ways the one best suited to reproduce drawings for text use. It is also satisfactory for plates; indeed there is scarcely any work that cannot be adequately and conveniently illustrated by it, if only the drawings are made with reference to this mode of reproduction.

Drawings must be in dead black ink (BOURGEOIS AINÉ, Encre de Chine Liquide; WINSOR and NEWTON, Liquid India Ink; HIGGINS, Waterproof Drawing Ink), and always in line and stipple only. Pale ink or a wash or tint make the use of the process impossible, unless the etching is supplemented by a second block in half-tone. Drawings should not be less than one half larger than the reproduction is to appear; preferably they should be of double size, and for open diagrams or charts treble or even quadruple size may be better. This permits refinement of line and fine shading without excessive care in making the original. To see how a coarse drawing will look a concave lens 4 or 5<sup>cm</sup> in diameter should be available. There are few observers who can draw at all, and none who draw well with a pencil, who cannot readily acquire the art of drawing with ink in a style suitable to be reproduced by copper or zinc etching. This gives freedom to put illustrations in the text where this is desirable, or to combine them into a plate if necessary.

Examples:—**26**: pls. 1, 2 (a fine example of pure line); **32**: pls. 10–12 (almost pure stipple); **33**: pl. 14 (line and stipple); **36**: facing p. 188 (map, letters and figures pasted on; red index lines and figures by second printing); **39**: facing p. 102 (map, two blocks made from single drawing

and printed separately); **38:** 347-361 (graphs and intricate tabular work; note especially insert after p. 356); **40:** pls. 10, 11 (line with wash; block a combination of half-tone and zinc; not recommended).

**6. Wood-cuts.**—The expense of this process is prohibitive, especially in view of the many mechanical processes whose results are equal or better.

**General suggestions.**—It is advisable for convenience in sending drawings and photographs by mail that they be unmounted. If they are to be arranged in groups that cannot be designated by serial numbers alone, they may be arranged as desired on a sheet of thin paper, the outline of each roughly traced thereon, and the chart folded and forwarded with the separate sketches or photos in a small package.

Index letters should be printed and pasted on at the end of index lines. Avoid the use of more than one letter at each line, but keep the same letter for the same structure throughout. *Syn* is no more significant, as applied to synergids, for anyone competent to read the paper, than the letter *s* or *x*. Sheets of printed letters and numbers will be supplied on request.

It is very instructive to compare original drawings and reproductions; much can be learned from a single experience which can be applied to modifying future work.

For drawing, an ordinary sharp Spencerian or Gillott pen is better than the excessively fine lithographic and crow-quill pens. Fine lines and very fine dots are not only entirely unnecessary, but too often they disappear in etching the plate, when moderately coarse lines and dots are properly reduced. Bold drawing on a large scale with proper reduction gives better results than the fine work done under a lens on a scale that permits only one fourth reduction or less. Plates may be printed in paler inks or tints to secure softness. Drawings unsuited to photographic reproduction are often excused on the ground that the author drew indistinctly because he saw the outline faintly. But a drawing which is dead black and shows the harshest contrast in order to be reproduced photographically, may be printed in as faint a tint as desired, thus reducing contrasts and eliminating the objectionable harshness. Where extreme gradations of tone are necessary, of course half-tone or photogravure should be employed.—CHARLES REID BARNES, *The University of Chicago*.